

## *Allocasuarina hystricosa* (Casuarinaceae): a new species from south-west Western Australia, with notes on related species

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### Abstract

Wege, J.A. *Allocasuarina hystricosa* (Casuarinaceae): a new species from south-west Western Australia, with notes on related species. *Nuytsia* 17: 403–414 (2007). *Allocasuarina hystricosa* Wege is described as new. Known largely from the Ravensthorpe region, this dioecious species is characterised by erect branchlets with 10–12 leaf teeth per whorl, long articles (mostly 15–35 mm long), and three (more rarely two or up to five) spines per cone bracteole protuberance. Revised descriptions are provided for the phylogenetically related species *A. scleroclada* (L.A.S.Johnson) L.A.S.Johnson, *A. corniculata* (F.Muell.) L.A.S.Johnson, *A. spinosissima* (C.A.Gardner) L.A.S.Johnson, *A. globosa* L.A.S.Johnson and *A. tortiramula* E.M.Benn., and a lectotype chosen for *A. tortiramula*. A putative new taxon, *A. spinosissima* subsp. short spine (D.L. Serventy & A.R. Main s.n. 25/8/1960), is highlighted for further research. The recent acquisition by the Western Australian Herbarium of a significant number of *Allocasuarina* specimens of Western Australian origin is noted.

### Introduction

A new species of *Allocasuarina* L.A.S.Johnson (Casuarinaceae) endemic to south-west Western Australia has come to light following recent botanical surveys of mineral leases near Ravensthorpe. *Allocasuarina scleroclada* (L.A.S.Johnson) L.A.S.Johnson subsp. Bandalup (G. Cockerton 7773) was flagged as a putative new taxon by Geoff Cockerton of Landcare Holdings Pty Ltd, and listed as being of conservation priority in view of its apparently restricted distribution. It is a tall shrub distinctive for its cones, in which the bracteole protuberance is usually divided into three spines.

*Allocasuarina scleroclada* subsp. Bandalup (G. Cockerton 7773) is formally described in this paper as a distinct species, *A. hystricosa* Wege, rather than as a subspecies of *A. scleroclada*. Whilst both taxa are dioecious and possess relatively long articles, 10–12 leaf teeth per whorl, and cones and samaras of a similar size and shape, they are readily distinguished on the basis of habit and cone bracteole morphology. Unlike *A. hystricosa*, *A. scleroclada* possesses distinctive drooping branchlets and cones in which the protuberances are prominently thickened and fused to the bracteoles (i.e. they are not spiny).

The spiny cones of *A. spinosissima* (C.A.Gardner) L.A.S.Johnson and, to a lesser extent, *A. corniculata* (F. Muell) L.A.S.Johnson resemble those of *A. hystricosa*, although they have only one spine per bracteole protuberance. These two species were placed into their own section (*A. sect.*

*Echinopitys* L.A.S.Johnson) in the “Flora of Australia” account of the genus (Wilson & Johnson 1989); however, a recent phylogenetic study based on *matK* sequence data, has indicated that this section is not monophyletic (Steane *et al.* 2003). This analysis placed *A. corniculata* and *A. spinosissima* in a well-supported albeit unresolved clade, together with the Western Australian species *A. scleroclada*, *A. globosa* L.A.S.Johnson and *A. tortiramula* E.M.Benn., and the eastern Australian species *A. luehmannii* (R. Baker) L.A.S.Johnson. In addition to describing *A. hystricosa*, this study provides revised descriptions and notes on the Western Australian members of this clade along with a commentary on the Western Australian collections of the genus housed at the Western Australian Herbarium (PERTH).

## Methods

Specimens at PERTH were examined for key diagnostic characters and their identification confirmed or amended. The descriptive format and terminology largely follows that of Wilson & Johnson (1989). The distribution map of *A. hystricosa* was compiled using DIVA-GIS freeware version 5.2.0.2 and is based on PERTH specimen data. Distributions are summarised according to the boundaries of the Interim Biogeographic Regionalisation for Australia, as modified on FloraBase (Western Australian Herbarium 1998–). Localities are withheld for taxa with a conservation listing.

## Taxonomy

### *Allocasuarina hystricosa* Wege, *sp. nov.*

Species haec ab *Allocasuarina scleroclada* (L.A.S.Johnson) L.A.S.Johnson ramulis erectis et bracteolarum protuberationibus spinosis differt.

*Typus*: east of Ravensthorpe, Western Australia [precise locality withheld for conservation purposes], 14 February 2007, *N. Gibson, G. Cockerton & G. Craig* NG 4585, with cones (*holo*: PERTH 07526784; *iso*: AD, CANB, MEL, NSW); *N. Gibson, G. Cockerton & G. Craig* NG 4586, with male flowers (*topo*: AD, CANB, MEL, NSW, PERTH 07526873).

*Allocasuarina scleroclada* subsp. Bandalup (G. Cockerton 7773), Western Australian Herbarium, in FloraBase, <http://florabase.dec.wa.gov.au> [accessed March 2007].

Dioecious shrub to 3 m high. Branchlets ascending, to 30 cm long; articles (10–)15–35(–45) mm long, 0.9–1.3 mm wide, glabrous, smooth to slightly furfuraceous, grey-green to yellow-green; phyllichnia flattened to slightly rounded; teeth 10–12 per whorl, erect, not overlapping, 0.8–1.5 mm long, 0.3–0.4 mm wide, margins ciliate, marcescent. Male spikes sessile on the permanent branches, 0.4–1.5 cm long, 12–15 whorls per cm; anthers 0.6–0.8 mm long. Cones sessile, oblong to elliptic, more rarely subglobose, truncate at apex, pubescent, becoming ± glabrous with age; cone body (10–)13–30 mm long, (10–)13–18 mm wide; bracts inconspicuous; bracteoles broadly ovate, apex with or without tiny mucro, dorsal protuberance divided into (2–)3(–5) spines, spines deciduous, reddish-brown; central awn pyramidal, separating near the base of bracteole body, 1.5–6 mm long, curved to straight, sometimes hooked at apex; minor lateral awns, subulate, occasionally pyramidal, 0.5–3 mm long. Samara 4.5–9 mm long, glabrous, red-brown to brown-black. (Figures 1; 2L, i)

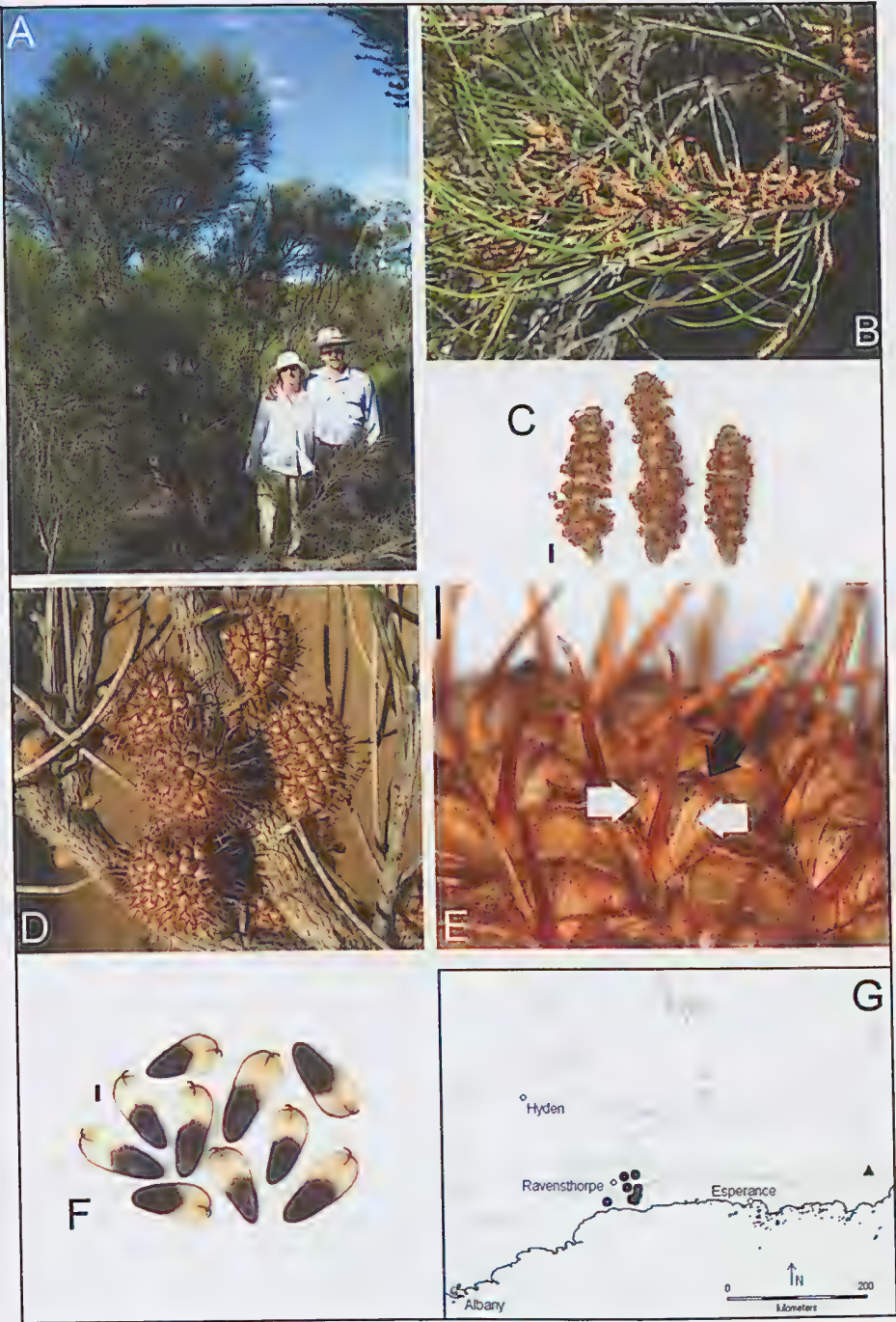


Figure 1. *Allocasuarina hystricosa* (N. Gibson, G. Cockerton & G.F. Craig NG 4585, 4586). A – Geoff Cockerton and Gillian Craig stand near individuals of *A. hystricosa*; B – male plant; C – male spikes; D – cones; E – spinose bracteole protuberances, white arrows indicate minor lateral spines, black arrow indicates a bracteole; F – samaras; G – distribution in southern western Australia, ● = *A. hystricosa*, ▲ = outlier population (R.D. Royce 10163) requiring field validation. Scale bars at 1 mm. Field photographs supplied by Stephen Kern and Geoff Cockerton (Landcare Holdings Pty Ltd).



*Selected specimens* (16 examined). WESTERN AUSTRALIA: [localities withheld] 12 Nov. 2004, J.A. Cochrane, S. Comer & S. Gilfillan JAC 5041 (PERTH); 19 July 2002, G. Cockerton 7773 (PERTH); 30 Apr. 2004, G.F. Craig 6078 (PERTH); 2 Nov. 1965, A.S. George 7249 (PERTH); 7 Mar. 2005, Landcare Services LCS 10539 (AD, CANB, MEL, PERTH).

*Distribution.* Known from a small cluster of populations in the Esperance Plains region of southern Western Australia; from Bandalup Hill, east to the Eyre Range to north-east of Ravensthorpe (Figure 1G). An outlier from Cape Arid National Park (R.D. Royce 10163) in the Eastern Mallee region may be referable to this species (see notes below).

*Habitat.* Occurring on plains, lower slopes and hilltops in orange, red or brown loam with limestone or granite outcropping. Recorded from mallee shrubland or heathland, shrubland with *Acacia ophiolothica* and *Hakea verrucosa*, and heathland with *Allocasuarina campestris*. Also noted to form small dense stands, sometimes in association with *Melaleuca pauperiflora* and *Gahnia lanigera*.

*Phenology.* Male flowers have been collected in February; female flowers in February, April, June and December.

*Conservation status.* Listed as Priority Three under Department of Environment and Conservation (DEC) Conservation Codes for Western Australian Flora by Atkins (2006), under the phrase name *A. scleroclada* subsp. Bandalup (G. Cockerton 7773). Further survey required.

*Etymology.* Derived from the Latin (*hystricosus*, prickly or thorny) in reference to the spine-bearing protuberances on the cones.

*Affinities.* *Allocasuarina hystricosa* shows close morphological affinity to *A. scleroclada* with both species possessing relatively long articles, non-overlapping teeth arranged in whorls of 10–12, cones and samaras of similar size and shape, and comparable male flowers. In contrast to *A. hystricosa*, *A. scleroclada* has drooping branchlets, and the cone bracteole and protuberance are prominently thickened and completely fused (Figure 2A). *Allocasuarina scleroclada* also tends to have longer articles and longer teeth, although there is some gradation in these features between the two species.

*Allocasuarina hystricosa* also resembles *A. spinosissima*. Both species have an erect habit, large cones and samaras, and spinose cone bracteole protuberances. *Allocasuarina spinosissima* differs from *A. hystricosa* in having male spikes with fewer whorls per cm (Figure 2E), cone bracteoles with only a single spine per protuberance (Figure 2F), shorter and wider articles, shorter teeth that overlap slightly at the base, and in being monoecious.

*Notes.* The spines on the bracteole protuberances are deciduous and therefore care must be taken when interpreting specimens bearing old cones. The central awn breaks off above its base leaving a small but distinctive swollen mound; however, when the lateral spines are lost, a scar is usually not evident. Specimens with older cones may therefore be confused with *A. spinosissima*, which is also recorded for the Ravensthorpe region.

A specimen from Cape Arid National Park (R.D. Royce 10163) possesses bracteole protuberances in which the central awn (c. 5–7 mm long) and two lateral awns (c. 3–4 mm long) are very prominently swollen at the base. Two additional subulate spines (to 1.5 mm long) are also sometimes present at the base of the central awn. Whilst these cones somewhat resemble those found in *A. hystricosa*, the

specimen has fewer teeth (9–10) per whorl. Further collections are required in order to assess whether this geographically disjunct collection is referable to *A. hystricosa*.

***Allocasuarina scleroclada*** (L.A.S.Johnson) L.A.S.Johnson. *Casuarina scleroclada* L.A.S.Johnson, *Nuytsia* 1: 261 (1972). *Type*: c. 40 km SSE of Caiguna, c. 3.2 km in from sea, Western Australia, 1 September 1967, *L.A.S. Johnson* 2155 (*holo*: NSW, with cones, *n.v.*; *iso*: PERTH 01545698!).

Dioecious shrub to 3 m high. Branchlets spreading or drooping, to 30 cm long; articles 18–60 mm long, 1.2–1.5 mm wide, smooth, glabrous, occasionally pubescent in furrows, often waxy, dull green to grey-green; phyllichnia flattened to slightly rounded; teeth 10–12 per whorl, erect, not overlapping, 1.3–3 mm long, 0.3–0.4 mm wide, margins ciliate, marcescent. Male spikes sessile on the permanent branches, 0.7–1.2 cm long, c. 12–13 whorls per cm; anthers 0.7–0.8 mm long. Cones sessile, subcylindrical to elliptic, rarely ovate or globose, truncate at apex, pubescent, becoming  $\pm$  glabrous with age; cone body 18–36 mm long, 13–20 mm wide; bracts inconspicuous; bracteole and protuberance fused, greatly thickened, broadly acute when young, becoming thickly obtuse, with or without a tiny mucro. Samara 5–8 mm long, glabrous, dark brown-black. (Figures 2A; 2L, ii)

*Selected specimens* (40 examined). WESTERN AUSTRALIA: 1 km NE of Deralinya, 15 Jan. 1989, *B. Archer s.n.* (PERTH); 312 miles Lake King – Ravensthorpe Road, 16 Jan. 1970, *E.M. Bennett* 3120 (PERTH); Halls Track, 29 miles W of Phillips River, 4 Nov. 1965, *A.S. George* 7311 (PERTH); 20 km NE of Ongerup, 16 June 1974, *K.R. Newbey* 4213 (PERTH); Cape Arid National Park, 10 km from Mount Ragged towards Esperance, 9 Sep. 1983, *J. Taylor & P. Ollerenshaw* JT 1577 (CANB, MEL, PERTH); 23 km S of Caiguna, 19 July 1967, *P.G. Wilson* 5930 (AD, PERTH).

*Distribution*. Scattered across the Mallee, Esperance Plains and southern Coolgardie regions of southern Western Australia, from east of Borden to south of Balladonia.

*Habitat*. Growing in clay or sandy loam on rocky hillsides, spongolite cliffs, limestone plains or adjacent to granite outcropping. Often associated with mallee shrubland, but also recorded from dense scrub, heath, *Triodia* grassland, and shrubland with *Melaleuca*.

*Phenology*. Female flowers are recorded for January, May, September and December; male flowers for January.

*Conservation status*. A scattered distribution spanning almost 800 kms. No conservation listing required.

*Notes*. A collection from Frank Hann National Park (*K.R. Newbey* 5436) has cones in which the dorsal protuberance is incompletely fused to the bracteole and so a very short spine is present near the apex of the bracteole. This specimen otherwise appears referable to *A. scleroclada*. A further two collections by Ken Newbey from the Eyre Range (*K.R. Newbey* 3171; Figure 2B) and south of Toompup (*K.R. Newbey* 1249D) have similarly anomalous cones, but also differ from *A. scleroclada* in having seemingly erect branchlets. I have placed both of these specimens under *A. ?scleroclada* in view of their prominently thickened cone bracteoles. Field observations are required to confirm whether these are anomalous specimens of *A. scleroclada* or referable to *A. hystricosa*.



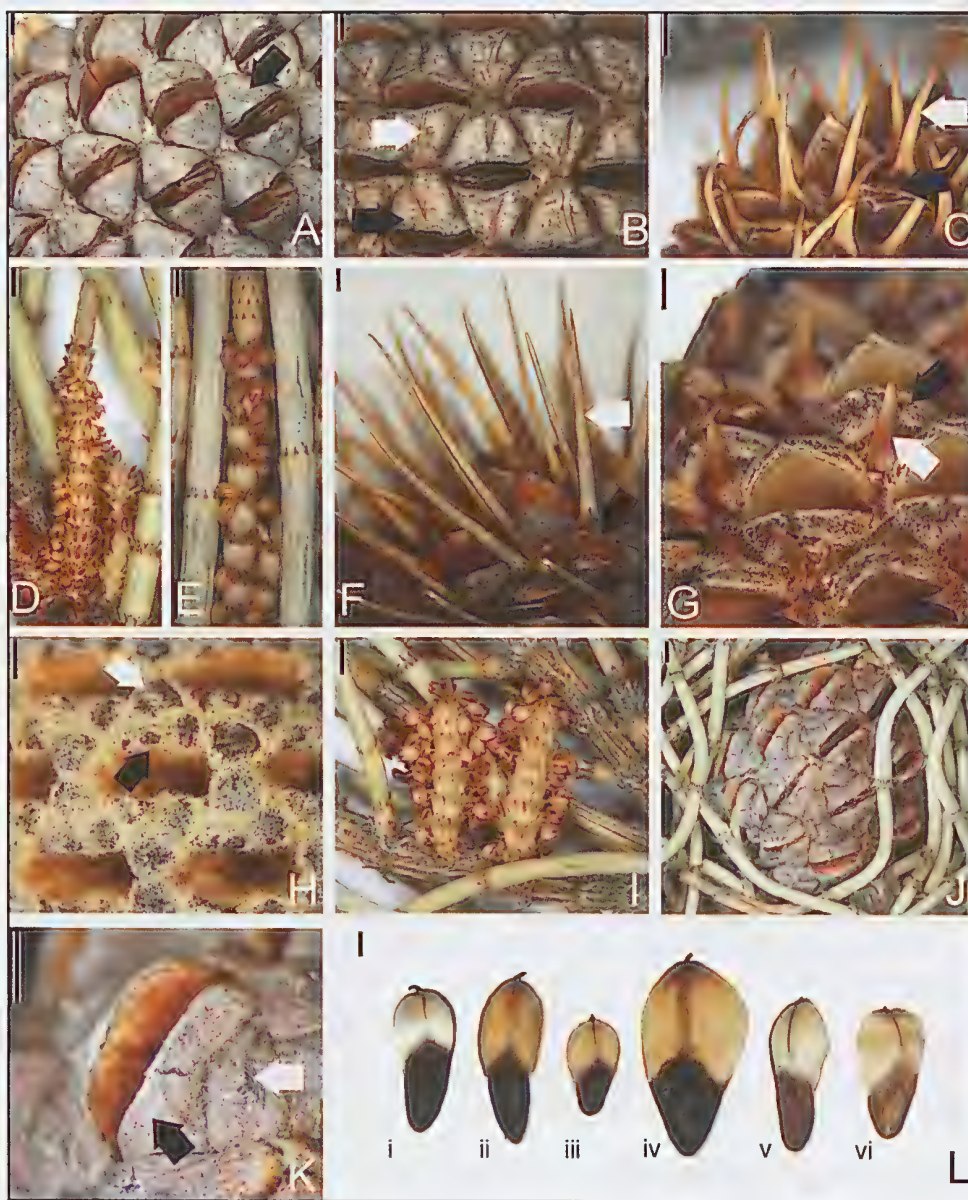


Figure 2. A – *Allocasuarina scleroclada*, prominently thickened cone bracteoles (E.M. Bennett s.n., PERTH 02222833); B – *A. ?scleroclada*, cone bracteole and protuberance incompletely fused (K.R. Newbey 3171); C – *A. corniculata*, spinose cone bracteole protuberances (N. Gibson & M. Lyons 3449); D – *A. corniculata*, male spike (B. Archer 1912); E – *A. spinosissima*, male spike (E.M. Bennett 2145); F – *A. spinosissima*, spinose cone bracteole protuberances (C.A. Gardner 1773); G – *A. spinosissima* subsp. short spine (D.L. Serventy & A.R. Main s.n. 25/8/1960), cones with short protuberances (M. Graham 070); H – *A. globosa*, divided, hairy and obtuse cone bracteole protuberances (N. Gibson & M. Lyons 1960); I – *A. globosa*, male spikes (L. Sandiford B15); J – *A. tortiramula*, cone amongst the twisted branchlets (C. Walter 92); K – *A. tortiramula*, bracteole with single, obtuse protuberance (C. Walter 92); L, samaras from i) *A. hystricosa* (N. Gibson, G. Cockerton & G.F. Craig NG 4585), ii) *A. scleroclada* (voucher as for A), iii) *A. corniculata* (as for C), iv) *A. spinosissima* (as for E), v) *A. globosa* (as for H), vi) *A. tortiramula* (as for J). Scale bars at 1 mm. White arrows indicate a protuberance, black arrows indicate a bracteole.

***Allocasuarina corniculata*** (F.Muell.) L.A.S.Johnson, *J. Adelaide Bot. Gard.* 6: 74 (1982). *Casuarina corniculata* F. Muell, *Fragm.* 10: 2 (1876). *Type*: near Mt Churchman, Western Australia, 1875, D. Young s.n. (*holo*: MEL, with cones, *n.v.*; *iso*: B, *n.v.*).

*Casuarina horrida* D.A.Herb., *J. Proc. Roy. Soc. W.A.* 7:87 (1921). *Type*: Burracoppin [published as Merredin], Western Australia, Nov. 1920, E. Wilson & D.A. Herbert EW 99 (*holo*: PERTH 01554107, with cones!; *iso*: A, UC, *n.v.*).

Dioecious, rarely monoecious shrub to 4 m high. Branchlets ascending, to c. 30 cm long; articles (3–)5–12(–16) mm long, 1–1.4 mm wide, smooth, glabrous, occasionally puberulent in furrows, yellow-green; phyllichnia flattened to slightly rounded; teeth 8–10 per whorl, erect to slightly spreading, not overlapping, 0.5–0.9 mm long, 0.3–0.4 mm wide, margins ciliate especially at apex but sometimes also at base, more rarely appearing glabrous, marcescent. Male spikes sessile on the permanent branches, 0.5–2 cm long, 12–16 whorls per cm; anthers 0.5–0.8 mm long. Cones sessile or on a peduncle to 6 mm long, spherical to elliptic, truncate at apex, pubescent, becoming  $\pm$  glabrous with age; cone body 7–16 mm long, 7–12 mm wide; bracts inconspicuous; bracteoles broadly ovate, apex subacute to acuminate, pyramidal protuberance separating near base of bracteole body and with a slender awn, 1–7 mm long, pungent, deciduous, curved to straight, apex sometimes hooked, yellowish. Samara 2.8–4.5(–5.5) mm long, glabrous, red-brown. (Figures 2C, D; 2L, iii)

*Selected specimens* (106 examined). WESTERN AUSTRALIA: 11 km W of Lake Grace on Roelands – Lake King Road, 4 Oct. 1989, B.J. Conn & J.A. Scott BJC 3326 (MEL, MO, PERTH); Queen Victoria Rocks, SW of Coolgardie, 16 Sep. 1966, A.S. George 8038 (PERTH); c. 9.8 km NNE of Mt Dimer, Hunt Range, Jaurdi Station, 23 Sep. 1995, N. Gibson & M. Lyons 3449 (PERTH); 17 km E of Norseman – Esperance road on old Hyden – Norseman track, c. 35 km NW of Norseman, 29 Oct. 2000, B.J. Lepschi, L.A. Craven & B. Archer 4410 (CANB, PERTH); c. 10 km along road from Lake Grace towards Dumbleyung at Lake Grace Lookout, 4 Nov. 1992, A.M. Lyne, L. Craven & F. Zich AML 1002 (AD, MEL, NSW, PERTH); Mt Marshall, 13 May 2000, J. Wege MMV 92 (PERTH).

*Distribution*. Widespread in the Avon Wheatbelt, Mallee and Coolgardie Regions of southern Western Australia.

*Habitat*. Grows in sand, sandy loam or clay loam, often with ironstone gravel or granite outcropping, on sandplains, uplands or flats. Commonly recorded growing in mallee woodland, although occurs in a range of other habitats including shrubland with *Allocasuarina acutivalvis* and *Acacia beauverdiana*, *Melaleuca uncinata* or *Acacia* spp. and *Callitris*; heath with *Allocasuarina campestris*; and thickets with *A. acutivalvis* and/or *Acacia stereophylla*, *Callitris preissii* subsp. *verrucosa* or *Acacia sibina*, *Grevillea obliquistigma* and *Micromyrtus hymenonema*.

*Phenology*. Male flowers have been recorded between April and November; female flowers for February, April, May and from August to November.

*Conservation status*. A widespread and common species. No conservation listing required.

*Notes*. Whilst *A. corniculata* mostly produces male and female flowers on separate plants, monoecious plants have recently been recorded (B. Archer 1911; C. Keating et al. BBOD 3/5; J.M. Flint 160).



***Allocasuarina spinosissima*** (C.A.Gardner) L.A.S.Johnson, Fl. Australia 3: 199 (1989). *Casuarina spinosissima* C.A.Gardner, J. Proc. Roy. Soc. W.A. 9(1): 38 (1923). *Type*: Carrabin, October 1922, C.A. Gardner 1773 (*holo*: PERTH 01546155!, with cones; *iso*: MEL n.v., PERTH 01545639!).

Monoeocious shrub to 3 m high. Branchlets ascending, to 28 cm long; articles 4–13(–16) mm long, (1–)1.2–1.8 mm wide, often furfuraceous and/or verruculose, glabrous, occasionally puberulent in furrows, grey-green; phyllichnia flattened to slightly rounded; teeth 9–11 per whorl, erect to slightly spreading, slightly overlapping at base, 0.6–1.2 mm long, 0.4–0.6 mm wide, margins ciliate (sometimes sparingly so), marcescent. Male spikes sessile on the permanent branches, 0.7–3.5 cm long, (6–)8–11 whorls per cm; anthers 0.8–1.2 mm long. Cones sessile or on a peduncle to 4(13) mm long, spherical to elliptic, truncate at apex, pubescent, becoming  $\pm$  glabrous with age; cone body (10–)15–25 mm long, (10–)13–20 mm wide; bracts inconspicuous; bracteoles obtuse with an acuminate apex, pyramidal protuberance separating near base of bracteole body and with a deciduous slender awn, 4–12 mm long, pungent, deciduous, curved to straight, yellowish. Samara (4.5–)5.5–9.5 mm long, wing hyaline with prominent median nerve, glabrous, red-brown to brown-black. (Figures 2E, F; 2L, iv)

*Selected specimens* (83 examined). WESTERN AUSTRALIA: 87 km W of Coolgardie Post Office on Great Eastern Highway, 6 Oct. 1998, *B. Archer* 1163 (NSW, PERTH); 1 km W of Doney Lagoon, Adalong Station, 22 Sep. 1988, *R.J. Cranfield* 7597 (CANB, PERTH); Bodallin South Road, 2.63 km S of Kent Road, Kent Road Nature Reserve, 24 Aug. 1999, *G.J. Keighery & N. Gibson* 6779 (PERTH); Flint's Farm, 50 km NE of Hyden, 27 Feb. 2000, *J.M. Flint* 161 (PERTH); 1 km S of Mallee Ridge, Solomko Road, Burngup Water Reserve, 18 Sept. 1996, *M. & J. Stewart* 16 (CANB, PERTH); 130 km WSW of Kalgoorlie, 30 Oct. 1974, *D.J.E. Whibley* 4705 (AD, PERTH).

*Distribution*. Widespread in the Avon Wheatbelt, Mallee and Coolgardie regions of southern Western Australia, extending into the Esperance Plains near Ravensthorpe, the Murchison region around Menzies, and the southern Great Victoria Desert near Queen Victoria Spring.

*Habitat*. Growing on sand, sandy clay, or clay loam most commonly in mallee woodland and mallee shrubland/heath. Also recorded for a range of other habitats including open *Acacia* and *Leptospermum* shrubland, *Acacia* and *Melaleuca* tall shrubland and shrubland/heath with *Allocasuarina acutivalvis*, *Callitris* or *Banksia elderiana*.

*Phenology*. Male flowers have been observed on specimens collected from January to May and August to October; female flowers for January, February, May and August to October.

*Conservation status*. A widespread species represented in numerous conservation reserves. No conservation listing required.

*Affinities*. *Allocasuarina spinosissima* appears most similar to *A. corniculata*. It was regarded as a synonym of *A. corniculata* by Bennett (1982), who observed continuous gradation with regard to cone size and article width. In contrast, Wilson & Johnson (1989) considered the larger cones and stouter articles of *A. spinosissima* to be taxonomically significant. They also noted *A. spinosissima* to have larger samaras, verruculose (rather than smooth) articles, broader teeth that overlap at the base, and male and female flowers on the same, rather than separate, plants.

There is a clear tendency for *A. spinosissima* to have larger cones, larger samaras and wider articles than *A. corniculata*, although I have observed some gradation in these features. Despite this, I am in



agreement with Wilson & Johnson (1989) that *A. corniculata* and *A. spinosissima* are distinct species. The morphology of the male flowers (fewer whorls per cm in *A. spinosissima*) is highly diagnostic (compare Figure 2D with 2E). In the absence of male flowers, and where the cones and samaras are of intermediate length, the morphology of the teeth and articles can be used in identification. *Allocasuarina corniculata* has comparatively smooth articles and the teeth do not overlap, whilst the slightly broader teeth of *A. spinosissima* overlap at the base. Furthermore, *A. spinosissima* is consistently monoecious whereas *A. corniculata* is usually dioecious (although monoecious populations have been recorded; see notes under *A. corniculata*).

*Notes.* In a small number of specimens, the spiny protuberances on a subset of bracteoles split along their length. This has been noted to occur in specimens from the vicinity of Lake King and Newdegate (*K.M. Allan* 239, *J.R. Knox* 65x020; *M. & J. Stewart* 16; *P.G. Wilson* 7054), Ravensthorpe (*M. Bennett* 98); Pingrup (*K.R. Newbey* 1272), Hyden (*A.M. Coates* 2540; *J.M. Flint* 120; *K.R. Newbey* 1079; *R.D. Royce* 10212) and Esperance (*R. Bruhn* 6/31197). These collections are otherwise referable to *A. spinosissima*.

Wilson & Johnson (1989: 133) note a collection from the north margin of the Nullarbor Plain (*D.L. Serventy & A.R. Main s.n.*) with unusually short spines on the cone bracteole protuberance. This collection also possesses conspicuously pubescent article furrows. The morphology of the articles, teeth and male flowers otherwise suggest a close affinity to *A. spinosissima*. This specimen is a close match to more recent collections from Gindalbi Station (*M. Graham* 070; Figure 2G) and north-north-east of Queen Victoria Spring (*S. Pearson* 9). The phrase name *A. spinosissima* subsp. short spine (*D.L. Serventy & A.R. Main s.n.* 25/8/1960) has been created to accommodate these specimens until their taxonomic status can be fully assessed. Field observations and/or additional collections (including male flowers and cones of various ages) are required.

***Allocasuarina globosa*** L.A.S.Johnson, Fl. Australia 3: 196 (1989). *Type:* Bremer Range, Western Australia, 25 October 1964, *J.S.Beard* 3838 (*holo:* PERTH 1059181!, with cones).

Dioecious shrub 1.5–3 m high. Branchlets ascending, to 20 cm long; articles (7–)10–28 mm long, 0.9–1.2 mm wide, smooth to furfuraceous, glabrous to shortly pubescent in furrows, grey-green; phyllichnia slightly rounded; teeth 9–12 per whorl, erect to slightly spreading, not overlapping, 0.6–1 mm long, 0.3 mm wide, margins ciliate, marcescent. Male spikes sessile on the permanent branches, 0.6–1.2 cm long, c. 11–12 whorls per cm; anthers 1–1.2 mm long. Cones sessile, subglobose to elliptic, apex truncate, densely pubescent, less so with age; cone body 11–21 mm long, 13–16 mm wide; bracts inconspicuous; bracteoles subacute, dorsal protuberance divided into 3 obtuse bodies surmounted by a tiny mucro. Samara 5–7.5 mm long, glabrous, pale to mid-brown. (Figures 2H, I; 2L, v)

*Selected specimens* (10 examined). WESTERN AUSTRALIA: [localities withheld] 14 Dec. 2004, *J.A. Cochrane & R. Butler* JAC 5262 (K, PERTH); 20 Sep. 1994, *N. Gibson & M. Lyons* 1960 (CANB, PERTH); 11 Jan. 1989, *L. Sandiford* B15 (PERTH).

*Distribution.* Known from a handful of scattered populations in the Coolgardie region of southern Western Australia, from near Norseman west to the Bremer Range.

*Habitat.* Greenstone ridges, lateritic hilltops and slopes. Heavy clay loam. Recorded from mallee shrubland and scrub with *Allocasuarina campestris*.

*Phenology.* Female flowers have been recorded in May; male flowers in January and October.

*Conservation status.* Priority One under DEC Conservation Codes for Western Australian Flora (Atkins 2006).

*Notes.* The male flowers of this species (present on *B. Haberley s.n.* and *L. Sandiford B15*) have not previously been described. (Figure 2I)

***Allocasuarina tortiramula*** E.M.Benn., Fl. Australia 3: 190 (1989). *Type:* west of Lake King, Western Australia [precise locality withheld for conservation purposes], 22 July 1987, *M. Graham* 1127 (*lecto*, here designated, with cones: PERTH 1071726!; *isolecto*: CANB, K, NSW, *n.v.*); *M. Graham* 1127 (*paralecto*, with male flowers: CANB, K, MEL, NSW, *n.v.*, PERTH 01018043!).

Dioecious shrub 1–2 m high. Branchlets to 12 cm long, spreading and twisted; articles 5–11 mm long, 0.7–1 mm wide, smooth, glabrous, occasionally shortly puberulent in furrows, grey-green; phyllichnia rounded with median groove; teeth 6–7 per whorl, spreading to erect, not overlapping, 0.5–0.8 mm long, 0.3 mm wide, margins ciliate, marcescent. Male spikes terminal, 0.5–1.3 cm long, c. 9–12 whorls per cm; anthers 1–1.2 mm long. Cones sessile, subglobose to elliptic, truncate at apex, sparsely pubescent, becoming  $\pm$  glabrous with age; cone body 8–15 mm long, 10–13 mm wide; bracts inconspicuous; bracteoles obtuse, protuberance obtuse, often surmounted by a short mucro, shorter than bracteole body. Samara (4–)5–6 mm long, glabrous, pale to mid-brown. (Figures 2J, K; 2L, vi)

*Selected specimens* (8 examined). WESTERN AUSTRALIA: [localities withheld] 15 Nov. 1991, *A.M. Coates* 3491 (PERTH); 20 Sep. 1999, *C. Walter* 92 (PERTH).

*Distribution.* Known from two populations occurring west and north-west of Lake King in the Mallee region of southern Western Australia.

*Habitat.* Gentle hill slopes, rocky rises. Red sandy loam over granite. Mallee shrubland with *A. campestris*.

*Phenology.* Female flowers recorded for September and December; male flowers for September and November.

*Conservation status.* Listed as Declared Rare Flora under the Western Australian Wildlife Conservation Act 1950, with a ranking of Vulnerable (Atkins 2006).

*Typification.* The type gathering of *A. tortiramula*, *M. Graham* 1127, comprises a female specimen (PERTH 1071726) and a male specimen mounted on a separate sheet (PERTH 01018043). These specimens are not linked in any way other than by collecting number (i.e. they are not designated as sheet one and sheet two). In accordance with Article 8.3 of the 2005 International Code of Botanical Nomenclature they must be considered duplicates. It is clear that both specimens were used to compile the description of *A. tortiramula*, although the author did not annotate either sheet.

Bennett, in verbal communication with T.D. Macfarlane prior to her publication of this species, selected the female specimen as the holotype. Unfortunately, this decision is not indicated in the protologue of *A. tortiramula*, although it is reflected in the label of the male specimen, which was subsequently altered by curatorial staff at PERTH to read *M. Graham* 1127B. I reject this modification to the original collecting number and, in accordance with Bennett's original wishes, choose the female specimen as the lectotype.

**A note on the Western Australian collections of *Allocasuarina* at PERTH**

The account of *Allocasuarina* for the “Flora of Australia” recognised 69 taxa, of which 29 were recorded for Western Australia (Wilson & Johnson 1989). Since this treatment, some 1200 specimens of Western Australian origin have been added to the collection at PERTH, representing approximately 40% of the Western Australian holdings of the genus. A breakdown of the specimens according to the decade of their collection (Figure 3) reveals a distinct spike in collection activity during the 1990s. A substantial number of specimens from the present decade have also been incorporated into the collection. These figures reflect the extensive collection effort that has occurred in Western Australia over the past 15 years, often in association with broad scale vegetation surveys and environmental assessment (e.g. the Regional Forest Assessment, Woodland Watch Project, Goldfields Ranges Survey, and Salinity Action Plan), but also as a result of smaller regional projects, targeted collections by DEC personnel, and the opportunistic collections of interstate and overseas botanists.

With such a significant increase in the number of specimens available for study, it follows that the descriptions presented in the Flora treatment will need a degree of modification. Furthermore, as this study has suggested, unnamed taxa may be embedded in the collection. An interactive key for the genus in Western Australia is in development (K. Thiele pers. comm.) which, in conjunction with a comprehensive review of the State’s collections, will lead to an improved understanding of the genus in Western Australia.

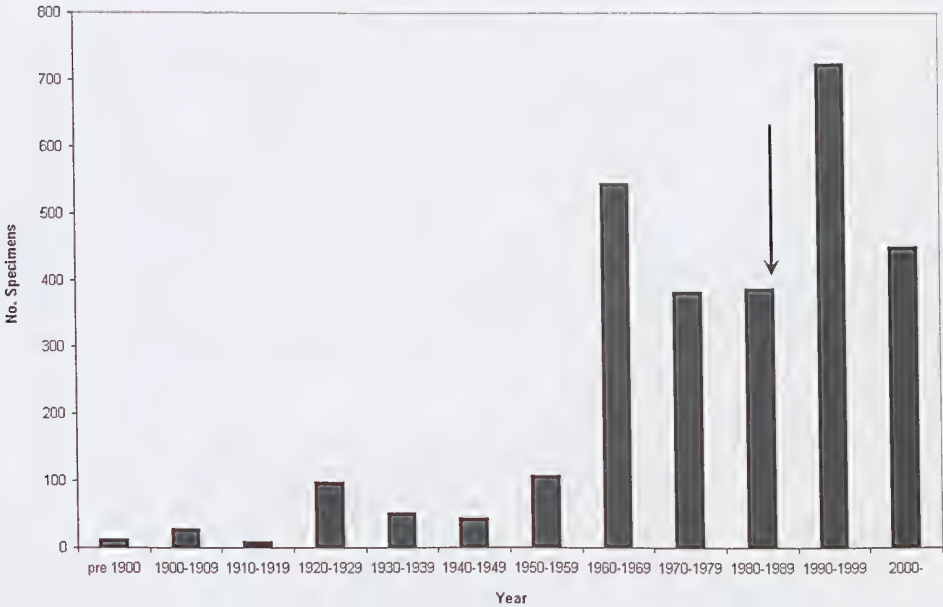


Figure 3. The number of *Allocasuarina* holdings of Western Australian origin housed at PERTH according to the decade of collection. The arrow indicates the Flora of Australia revision of Wilson & Johnson (1989). Note that the low number of acquisitions from the 1800s and early 1900s reflects, in part, the relative dearth of historical herbarium collections at PERTH.



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